

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

Middle School

Materials/Preparation

- ☐ Teacher Material A – Germination Research Activity – one per teacher
- ☐ Assessment A – Multiple Choice Quiz – one per student
- ☐ Clear plastic cups
- ☐ Cotton balls
- ☐ Pea seeds
- ☐ Bean seeds
- ☐ Radish seeds
- ☐ Corn seeds
- ☐ Water droppers
- ☐ Thermometers
- ☐ Various fluids
- ☐ Various lights (grow light, incandescent, fluorescent, halogen, LED)
- ☐ Paper

Fun Fact

Both summer and winter squash belong to the plant family that contains melons and cucumbers, and come in many different shapes and colors. Even though some varieties grow on vines and others grow on bushes, squash are commonly divided into two groups, summer and winter.



Germination Research

Minnesota K-12 Academic Standards

Science	5.1.1.2.	Scientific inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.
Science	7.1.1.2	Scientific inquiry uses multiple interrelated processes to investigate questions and propose explanations about the natural world.
Language Arts	6.14.2.2	Write informative/explanatory texts, as they apply to each discipline and reporting format, including the narration of historical events, of scientific procedures/experiments, or description of technical processes.

Summary/Overview

Students discuss factors that affect the amount of time it takes a seed to germinate. Then they perform a mini experiment involving the steps of the scientific theory.

Garden Connection

Germination occurs when a seed sprouts a tiny plant. Students learn factors that influence germination.

Background Information

Germination is when a sprout is seen coming out of a seed. When a seed is planted, the goal is for it to sprout and grow into a plant. However, many things can either stop or enhance the sprouting of a seed. Factors that may influence germination include amount of light, temperature, type of moisture applied, type of seed, time of day planting occurred, orientation of seed, and type of gas exposed to the seed (i.e. carbon dioxide, oxygen).

Objectives

- Define germination.
- List factors that influence seed germination.
- Apply research methods to investigate an agricultural problem.

Procedure

Interest Approach

Show students a dying houseplant. As they observe this yellowish/brown and wilted plant they might start to ask questions: How did it become wilted? What caused it to turn brown? As students observe this gloomy-looking plant, their questions become a hypothesis for why the plant is dying. Ask students to name the process they are beginning (scientific process).

Summary of Content and Teaching Strategies

Inform students they will conduct the first few steps of the scientific method while carrying out a seed germination lab. Start by discussing the definition of germination: when a sprout is seen coming out of a seed. Have students write the definition in their notes.

Explain that seeds are planted with the goal of growing a plant. However, many things can either stop or enhance the sprouting of a seed. Lay out five to ten different seeds on a display table or pass them around for students to observe. Pictures of seeds could be used in place of real seeds.

Observation

Have students write down three to five observations about the seeds; this may include seed size, shape, color, or texture. They may be individual observations or comparable. Students share their observations with the class.

Question

If the goal of the seed is to sprout, what factors affect the amount of time it takes for a seed to germinate? Start a classroom discussion that evaluates what affects the seed germination rate. Ask questions such as: What factors make a seed germinate? What would stop a seed from germinating? What is the ideal condition for a seed to germinate the quickest? Take notes on the board. Answers could include:

- Amount of light
- Temperature
- Amount and type of moisture applied
- Type of seed
- Time of day planting occurred
- Orientation of seed
- Type of gas exposed to the seed (i.e. carbon dioxide, oxygen)

Students should select one of the factors mentioned during the discussion to test. They should develop a question about the factor.

Hypothesis

Next students will create a hypothesis. They should make an educated guess answering the question they developed. The hypothesis must be a prediction about what will happen when the selected question is tested.

Test

After students create a hypothesis, have them follow the steps on Teacher Material A to start their lab. Use a variety of different seeds. It is best if students are able to plant their seeds on a Monday so they have 24-hour intervals to watch their seeds germinate.

Although everyone's hypothesis may be slightly different, all students complete the first three basic steps of the procedure. Have students retrieve their lab materials from the display table and return to their seats. Next they follow steps one through five, or modify these steps based on their hypothesis.

Review/Summary

Have students think back to when they were small children. Ask them to name their favorite Mother Goose rhyme. Students now create their own nursery rhymes. Divide the group into pairs or trios. Challenge them to re-write the words with their newly learned knowledge about the scientific method to the rhyme of "Mary Had a Little Lamb." Rhymes should have a title and includes all five steps of the scientific method. Give students five minutes to write rhymes. If student groups are reluctant to share, have an example ready to show your own involvement. Grade students on completed content and creative elements.

Modifications/Extensions

If your school has a greenhouse, take students out to the greenhouse and have them work on planting seeds of bedding plants for a plant sale.

Have students create a card (business card size) with the scientific method printed on it. Attach the card to a magnet and display as a reminder in a locker or another handy place.

Sources/Credits

Adapted from: National FFA Organization *Middle School Food and Agricultural Literacy Curriculum*, sponsored by the National Pork Board as a special project of the National FFA Foundation. Visit www.ffa.org/documents/learn/MS.AST.2.6.pdf to access the full-length version of this lesson.

Germination Research Activity

Germination: when a sprout is seen coming out of a seed.

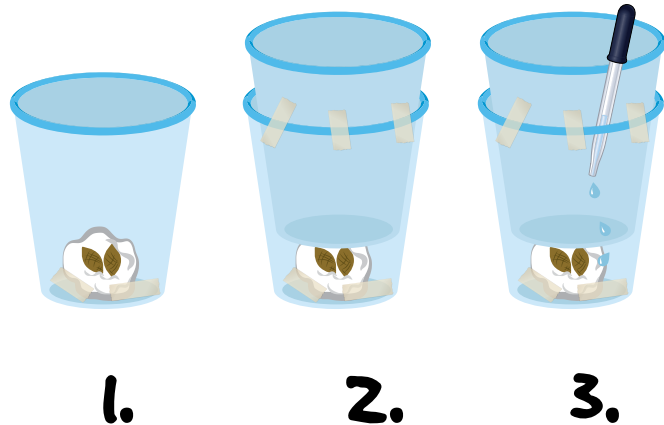
Question

What factors affect the amount of time it takes for a seed to germinate?

Laboratory Steps and Set-Up

Procedure:

1. Tape a cotton ball containing two seeds to the inside of a plastic cup.
2. Place another cup inside the first to further secure the seeds.
Tape the inside cup in place.
3. Use a dropper to add liquid so the cotton ball does not dry out.
4. Make observations each day.



Writing Activity

Incorporate the five steps of the Scientific Method when writing your nursery rhyme.

Five Steps of the Scientific Method:

1. Observation
2. Question
3. Hypothesis
4. Test
5. Conclusion

Name _____

Multiple Choice Quiz



1. When observing seed germination, which attributes of a seed will you observe?
 - a. Shape
 - b. Size
 - c. Color
 - d. All of the above
2. The definition of germination is what?
 - a. When a sprout is seen coming out of a seed
 - b. When a seed grows
 - c. When a plant produces flowers
 - d. When a seed is planted in soil
3. Observations and hypothesizing are the first steps in what process?
 - a. Scientific process
 - b. Scientific method
 - c. Scientific theory
 - d. Scientific steps
4. An educated guess is what?
 - a. Observation
 - b. Test
 - c. Hypothesis
 - d. Conclusion
5. After creating a hypothesis, you must examine what _____ may influence it.
 - a. steps
 - b. factors
 - c. observations
 - d. people